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U. S. DEPARTMENT OF AGRICULTURE.

REPORT

OF THE

CHIEF OF THE BUREAU OF BIOLOGICAL SURVEY

FOR

1909.

BY

C. HART MERRIAM.

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REPORT OF THE CHIEF OF THE BUREAU OF BIOLOGICAL SURVEY.

U. S. Department of Agriculture,
Bureau of Biological Survey,
Washington, D. C., October 23, 1909.

Sir: I have the honor to transmit herewith a report on the work of the Biological Survey for the fiscal year ended June 30, 1909, with outline of work for 1910.

Respectfully,

C. Hart Merriam,
Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

WORK OF THE BIOLOGICAL SURVEY.

The work of the Biological Survey as laid down by Congress is conducted under three general heads: (1) Investigations of the economic relations of birds and mammals to agriculture; (2) investigations concerning the geographic distribution of animals and plants with reference to the determination of the life and crop belts of the country; (3) supervision of matters relating to game preservation and protection, and importation of foreign birds and other animals.

ECONOMIC MAMMALOGY AND ORNITHOLOGY.

HOUSE RATS.

During the past year the causes of the continued abundance of house rats have been investigated with a view to the suggestion of adequate means of relief. Hitherto efforts against the pests both in the United States and in foreign countries have been directed chiefly to their destruction, with the result that while in all parts of the civilized world enormous numbers have been killed, rats still continue to flourish, chiefly because their wonderful reproductive powers enable them in any given locality to make good their losses very soon after the warfare against them has relaxed.

Traps and poisons of many different kinds have been experimented with during the year, and the results published in a recent bulletin. These methods of reducing the numbers of rats are believed to be necessary, and are very successful when intelligently and persistently employed, especially when food supplies are cut off. Careful experiments also have been made with certain bacterial preparations which are being widely advertised and sold as efficient rat exterminators.

The results obtained do not justify recommending them to the public. The cultures are neither cheap nor certain of action and, more important still, experiments have failed to show that they induce contagious diseases. Usually their effect is limited to the individuals eating the infected bait, and hence they are no better—and much more expensive—than certain well-known mineral and vegetable poisons..

While means of destruction have a decided value and must continue to be employed, they should be viewed only as auxiliaries to surer, and in the end much more economical, measures. Three recommendations are considered of primary importance: (1) The rat-proofing of all buildings that can possibly harbor the vermin; (2) the fumigation of rat-infested ships, especially freighters; (3) the withholding of food supplies from rats.

(1) Rat-proofing of buildings.—The cost of rat-proofing dwellings, stables, markets, and public buildings is slight compared to the losses the rats that harbor in them inflict on food, clothing, merchandise, and wooden structures, to say nothing of the menace the animals are to public health.

(2) Fumigation of ships.—In connection with efforts to rid cities, especially seaports, of rats, too little attention has been paid to the agency of vessels, especially freight carriers, in distributing the vermin. Great numbers of the rodents are transported in vessels from country to country and from seaport to seaport, and the loss they cause by the destruction of goods in transit is very great. But far more important is the fact that it is chiefly, if not wholly, by the agency of rats transported in vessels that bubonic plague is carried from one country to another. By modern methods of fumigation vessels can be cleared of rats, and, incidentally, of all other vermin, at slight expense. Seaports can never be permanently freed of rats, no matter how large the sums expended, when incoming vessels carry hundreds of rodents ready the moment opportunity offers to exchange their limited quarters aboard ship for the friendly land. If the general rat-proofing of dwellings and other buildings can be effected, and if at stated intervals the disinfection of vessels that transport and distribute rats can be made mandatory, important steps will have been taken toward a final solution of the rat problem.

(3) Withholding food supplies.—A third vitally important measure, possibly the most important of all, is the withholding of food supplies from the rodents. In towns and cities this can be effected by strictly enforced ordinances compelling the storage of kitchen and market refuse and all sorts of waste food in closed metal containers, which must be emptied systematically and often. Not the least important gain by withholding ordinary food supplies from the rats is the increased efficiency of traps, poisons, and other devices for destroying the pests, which, when food is abundant, are comparatively useless.

The above measures would result in so reducing the numbers of rats that they could do little harm, and no doubt within limited areas they might be exterminated. It is of the utmost importance to recognize the fact that the destruction of rats by any and all known means can, from the nature of the case, afford only temporary relief, and that complete freedom from the pests will follow only when repression is supplemented by prevention.

GROUND SQUIRRELS.

Most of the territory west of the Mississippi River is infested by ground squirrels. Though the many species vary much in size and in capacity for mischief, all are destructive, and in certain regions, especially the wheat regions of Washington, Oregon, Idaho, and California, they do an immense amount of damage every year. So destructive are they in certain localities that between the amount of grain they destroy and the cost of fighting them a large part of the profit of wheat raising is swallowed up. For a long time experiments have been conducted for the purpose of finding cheap and effective methods of destroying the animals. One of the larger and most destructive species is the so-called Columbian ground squirrel of eastern Washington. Thus far attempts to poison this species on a sufficiently large scale to stop its ravages in the wheat fields have failed, and the best way of holding it in check is by the use of steel traps.

The Beechey ground squirrel of California is another destructive species. This animal has been for years a perennial source of annoyance and loss in California, and immense sums have been expended in attempts to control its ravages. The importance of its destruction on a large scale, since its extermination does not seem possible at present, has been emphasized by the recent discovery by the Marine-Hospital Service that, like the rat, this animal, through the agency of the flea it harbors, has become a factor in disseminating bubonic plague. In the outskirts of towns situated near the seacoast the squirrels obtain plague-infected fleas from rats and, in turn, become hosts for this dread disease.

For some time the Biological Survey has been conducting field experiments with a view to the discovery of better and less costly methods of destroying the animals, and during the past few months its efforts have been most successful.

Cooperation with the Marine-Hospital Service.—At the request of the Chief of the Public Health and Marine-Hospital Service, the Chief of the Bureau furnished for publication a paper defining the distribution of three species of California ground squirrels, describing their general habits and giving approved methods of destroying them by means of traps, poisons, and gases.

FIELD MICE.

No outbreaks of field mice comparable to the one which did so much damage to the alfalfa fields of Humboldt and Carson valleys, Nevada, in 1908, have been reported during the present year. These areas were revisited in August for the purpose of ascertaining to what extent the mice had been destroyed. It was found that the wholesale poisoning carried on by the Survey, together with disease, had so reduced the number of mice that their natural enemies, especially hawks, owls, gulls, and coyotes, had almost exterminated the rest, there remaining in the spring probably not more than 5 or 6 to the acre, whereas during the height of the scourge small areas contained no fewer than 12,000 to the acre. At both Lovelocks and Minden few signs of mice were seen. In consequence of their scarcity

most of the hawks and owls, and probably also the larger carnivores, had betaken themselves to new hunting grounds, but when the fields were irrigated in the spring gulls reappeared in large numbers and, following the water from field to field, destroyed the remaining mice and pocket gophers flooded out of their holes. If the natural foes of rodents were everywhere protected and allowed to populate the country in normal numbers, they would exercise a constant check on the rodent pests, which then would rarely, if ever, multiply so as to become a scourge.

In many localities field mice infest orchards, and, as they work underground, they often, especially in winter, do great damage before they are suspected. A case in point occurred at Massies Mill, Va., where depredations by field mice in an orchard were reported, and an assistant was sent to investigate. Of a total of over 2,500 trees, probably more than half were damaged by mice, which girdled the roots below the ground. The cure in such cases is usually easy, as field mice can be readily poisoned with strychnine.

WOLF AND COYOTE BOUNTIES.

The bounty system designed to bring about the extermination of certain noxious animals, especially wolves and coyotes, has in many places proved an incentive to fraud, and thousands of dollars have been paid for the scalps of dogs, foxes, coons, badgers, and even cats and calves, which have been palmed off for wolves or coyotes. To aid state and county officers in identifying the scalps of wolves and coyotes, especially the young, a key has been prepared describing the essential distinguishing characters. This has been distributed freely in the bounty-paying States, and is expected to effect a substantial saving.

FENCING SHEEP FROM WOLVES AND COYOTES.

For several years the Survey, as a result of its own and of private experiments, has recommended the use of wire fencing as the most effective means of protecting sheep against wolves and coyotes. This method has the additional advantage that the pasturage within the inclosure is more abundant and of better quality than when sheep are grazed in compact herds under the care of herders. In 1907 the Forest Service inclosed an experimental sheep pasture in the Imnaha National Forest, Oreg., with a wire fence, the specifications for which were furnished by the Survey. The plan has proved a complete success. As wolves and coyotes are practically the only predatory animals feared by sheep owners in most parts of the country, it is believed that these wire fences will solve the sheep problem in many places where now the annual losses from wolves and coyotes are almost prohibitive of the industry.

DITCH BORERS.

As is well known, muskrats, pocket gophers, ground squirrels, and other rodents do much damage by tunneling into dikes, fills, and water ditches, thereby causing extensive breaks, which are costly and difficult to repair.

At the request of the Reclamation Service the subject was investigated by the Survey and efficient means of trapping and poisoning

the animals were devised and demonstrated to the engineers in charge of several of the projects. An examination of many miles of ditching during the past season showed few traces of mammal work, and the engineer in charge of the work at Fallon, Nev., reports that in consequence of the trapping and poisoning carried on by the ditch riders no important breaks had occurred during the year, whereas formerly breaks were numerous.

DEPREDATIONS BY KANGAROO RATS.

Hitherto few complaints have been received of depredations by the group of rodents known as kangaroo rats, the species of which are confined to the arid region west of the Mississippi. Early in the spring, however, reports were received of damage by these animals in vineyards of the Ben Lomond Wine Company, Santa Cruz Mountains, California, and request was made for a remedy. The animals had bitten off the fruit buds to store in their underground galleries, and the manager estimated the aggregate loss to be fully 25 tons of grapes. It was recommended that raisins poisoned with strychnine be freely distributed near the burrows of the rats, with the result that when the place was inspected in September by an assistant of the Survey, very few were found to have survived. Few of our rodents are more easily poisoned than kangaroo rats, and it is believed that wherever they are troublesome, as they occasionally are in both vineyards and wheat fields, their numbers may be speedily reduced by the above means.

MOLES.

Despite the fact that moles are almost exclusively insectivorous, complaints against them are frequent because of damage in gardens, especially to plants and bulbs, supposed to be the work of these animals. In such cases the real offender is almost always the field mouse and not the mole. Nevertheless the mole occasionally injures lawns by tunneling under and upheaving the turf. Hence during the year experiments were made to determine the practicability of poisoning the animals, and considerable data on their food habits were gathered.

MAMMALS OF THE ARID INTERIOR.

The great reclamation projects now under way in the far West are making available for agricultural uses great tracts of desert land hitherto inhabited chiefly by wild animals. Many of the settlers are new to the region, and being wholly unacquainted with its animal life, are unable to distinguish friends from foes. At the request of the Reclamation Service and of some of the resident farmers, a bulletin has been published describing briefly the appearance and habits of the commoner mammals of the region, so that the farmer may be enabled to distinguish the beneficial from the injurious kinds. To add to the practical value of the bulletin the best methods of destroying the noxious species are also given. Though the bulletin applies more particularly to the Carson and Humboldt valleys, Nevada, it serves almost equally well for nearly the entire sagebrush region of the Great Basin.

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MUSKRATS.

The diminished numbers of fur-bearing animals and the enhanced value of furs invite attention to measures for increasing the supply. To-day one of the most important of the American fur-bearers is the muskrat, which is still numerous and widely distributed in the United States, and whose fur is suited to a variety of uses.

Unlike some of the fur-bearers, as the fox, the muskrat can not be profitably raised in a semidomesticated state, but its food and other habits are such that large areas of marsh land along river and coast, of small value for agricultural purposes, may profitably be devoted to the animal. This is already done on the western shore of Maryland, and tracts of considerable size have yielded much larger returns in muskrat pelts than could have been obtained from them in any other way.

The muskrat is already protected wholly or partly in many States. Its importance as a fur-bearer, however, should secure its protection in all. A closed season of at least nine months should be established, which should include all the breeding months. The muskrat is prolific, has several litters a year, and, if properly protected, will not only hold its own but will increase in numbers.

The flesh of the muskrat furnishes an excellent and nutritious food, and in sections where its qualities are known it finds ready sale in markets at prices which add considerably to the returns from the pelts.

It is only in a few places, where farming land closely adjoins streams or marshes, that the animal injures crops, and in such cases the crops are usually easily protected. But the damage to ditches and embankments, particularly in certain irrigated areas of the West, is more serious. A bulletin covering these and other phases of the subject has been prepared.

DEER FARMING.

The Survey has continued to collect statistics relating to deer and elk parks, and also information concerning attempts to raise deer for venison. The Farmers' Bulletin issued last year, giving practical directions concerning deer farming, has been supplemented by a fuller report on the same general subject.

RELATION OF BIRDS TO THE BOLL WEEVIL.

In November an assistant of the Survey visited Adams, Jefferson, and Wilkinson counties, Miss., to study the relations of birds to the boll weevil. This State has recently been invaded by the pest in its march eastward, and the investigation was for the purpose of ascertaining to what extent birds were eating this, to them, new insect. It was found that only a few were doing so, a result which confirms previous experience in other places. Time is required for birds to learn the habits of newly introduced insects, so as to become efficient in their destruction. No doubt in Mississippi and the other Gulf States, as they in turn are invaded by the weevil, the resident birds will learn to attack the weevil in the cotton squares and other hiding places, and thus will lend material aid in checking its spread and diminishing its numbers, as they have already done in Texas.

CALIFORNIA BIRDS IN RELATION TO THE FRUIT INDUSTRY.

Orchard trees are peculiarly subject to the attacks of insect pests, and in a State like California, where the acreage devoted to fruit, already large, is constantly increasing, a knowledge of methods of controlling such pests is very important. Since birds consume enormous numbers of insects, they are valuable auxiliaries in reducing the ranks of insect pests. Both because of their insectivorous habits and because some birds eat fruit, a knowledge of their food habits is important to orchardists. Accordingly, investigations of California birds in relation to the fruit industry have been carried on for several years. During the past year Part II of a report on the subject has been finished. Although dealing specifically with California birds, much of the information it contains applies also to the fruit districts of the entire West Coast.

ENGLISH SPARROW.

As outlined in the last report, efforts have been made in connection with the local authorities of Los Angeles County to exterminate the colonies of English sparrows which have thus far gained a foothold south of Tehachapi Pass, and thus prevent the disastrous spread of the species in Southern California. In order to avoid duplication of work, arrangements were made whereby the county game warden in charge of the work for the county board of supervisors devoted his efforts to Los Angeles and the stations along the Southern Pacific Railroad northward to Lancaster. He reports that in this territory about 1,682 birds were destroyed, as follows: Los Angeles, 9; Newhall, 166; Saugus, 31; Ravenna, 7; Lang, 21; Acton, 31; Vincent, 18; Palmdale, 389; Lancaster, 1,010.

The large number at Lancaster was probably due to the fact that this locality is one of the most available for the birds on the Mohave Desert. A representative of the Survey, in cooperation with the boards of horticulture of San Bernardino and Riverside counties, made an examination of the stations along the Southern Pacific Railroad east of Los Angeles and through San Gorgonio Pass, and established the fact that the English sparrow had not yet entered Southern California by this route. He then proceeded along the Santa Fe road from San Bernardino to Barstow, destroying such birds as he found at Victorville. At Barstow, however, he failed to find the English sparrow, either in the railroad yards or about the town. These localities were again visited the first week of April, and sparrows found at Victorville were destroyed, and the presence of the species at Barstow was demonstrated. The colonies were visited a third time in June, and preparations were made to continue the work westward along the Santa Fe Railroad to Mohave and at other points along the coast line of the Southern Pacific between Los Angeles and Ventura.

The results thus far accomplished show that the sparrow colonies in Southern California, though small, are likely to increase and spread, if efforts to extirpate them are not persistent. It is very difficult to destroy every English sparrow in a given locality, and

even when this is done new immigrants are likely to come in on the cars. Efforts are therefore directed chiefly toward warning local residents of the danger from the pests and demonstrating the ease with which the colonies, if attended to in time, can be destroyed at moderate expense.

WOODPECKERS.

Woodpeckers are among our most beneficial birds and render important aid in preserving our forests and shade trees by digging out injurious insects from their retreats in the trunks and branches. Much work on the food of this species has been done during the past year, and when certain additional data are obtained a revision of the bulletin on the food of woodpeckers, issued in 1895 and now out of print, will be prepared.

Useful as are most of the members of this group, many complaints are received against the several members of one section of the family. These are the sapsuckers, which habitually dig into the bark of trees for the purpose of obtaining the sap which exudes from the wounds; they eat also the cambium or inner layer of the bark. The injuries thus inflicted sometimes result in the death of the tree. In addition, investigations now in progress show that timber otherwise sound is so injured by stains and distortions, the result of nature's efforts to repair the damage inflicted by the sapsuckers, that its value for manufacturing purposes is seriously impaired. The members of this group, therefore, may properly be exempted from protection.

FLYCATCHERS.

The flycatchers constitute one of the most important groups of insectivorous birds, and contains numerous species whose services to the farmer are of great value. During the year more than 3,000 stomachs of 17 species of flycatchers have been examined preliminary to the preparation of a bulletin on the economic relations of the more important members of the family.

BIRDS IN RELATION TO WHEAT APHIDS.

The so-called green bugs or wheat aphids, a pest introduced from Europe, have done much damage in the grain fields of North Carolina, and early in April an assistant visited Forsyth County to ascertain whether any of our native birds were attacking the insect and to what extent. It was found that several native species of sparrows were resorting in great numbers to the infested fields and were feeding largely on the green bug and other wheat lice. The birds destroyed many thousands of the insects each day, and the effect of their work was to limit the insects' ravages and to save much wheat and other grain which, but for their aid, would have been lost.

SHORE BIRDS.

Substantial progress has been made in studying the food of snipe, sandpipers, and plovers. Among other interesting facts developed it has been ascertained that certain species devour large numbers of mosquito larvæ. They thus effectively supplement the work of fishes

in reducing the numbers of these disease-carrying pests, more particularly as they obtain many of the larvæ in isolated pools and shallow water not frequented even by minnows. A bulletin on this group, with special reference to their breeding resorts, their winter homes, and their migration routes, has been completed.

FOOD OF WILD DUCKS.

Investigations of the food of wild ducks have been continued for several years, the chief purpose being to obtain information as a guide to legislation on this important group of birds—important both from the standpoint of the sportsman and as a source of food supply. As certain species of ducks diminish to the point where extinction threatens, they may be preserved either by being bred in a state of partial domestication, or else ponds and streams surrounded by tracts of suitable marshy land may be set apart as duck preserves, where the ducks may resort to breed unmolested. Where other conditions are favorable and only proper feed is wanting, this may be supplied by transplanting various species of aquatic plants. During October and November an assistant visited certain ducking grounds in Wisconsin and Michigan in order to determine the kind of plants on which the ducks of that region chiefly feed. In addition, much information was obtained from hunters and sportsmen, and as a result of the direct relations established with these men, more than 1,200 duck stomachs were secured for examination. A bulletin on the food of ducks is now being prepared.

DISEASES OF WILD DUCKS.

It was learned that the wild ducks of Lake Pequa, Wisconsin, were affected with a disease which each year destroyed several thousand. A number of the dead birds were obtained and turned over to the Bureau of Animal Industry for examination and report. The disease proved to be coccidiosis, which manifests itself by severe inflammation of the intestines. It is caused by a protozoan, and results in imperfect assimilation and often in death by starvation. The organism responsible for the disease is believed to be the same that causes the white diarrhea in chickens. The obvious remedy is to prevent, when possible, the pollution of waters frequented by wild fowl by streams draining farms and poultry yards.

GEOGRAPHIC DISTRIBUTION.

As usual, investigations in this branch of the work covered a wide field and included many States. Vernon Bailey, assisted by C. E. Birdseye and E. A. Goldman, spent several months in New Mexico making collections to define the life zones of the Territory and studying the food habits of its birds and mammals. E. W. Nelson completed a report on the rabbits of North America, which is now published and distributed. Comparatively little has been known of the distribution and the relations of the numerous species of this group of mammals, economically important both as a source of food and because of the great damage they do in various parts of the country.

The biological survey of Utah, begun years ago but dropped on account of more urgent work, was again taken up and carried on for three months by W. H. Osgood. A. H. Howell did much field work in Georgia, Alabama, Mississippi, Tennessee, and South Carolina for the purpose of filling in gaps in our knowledge of the faunas of those States. He also made extensive collections of birds and mammals with reference to life-zone work and investigated the relations of birds to the boll weevil in the recently invaded parts of Mississippi. During the latter part of the year N. Hollister visited certain areas in California and made special studies of the breeding grounds of certain economically important birds. He also made collections of birds and mammals in connection with a general map of the life zones of that State. A report on work in Alaska during the seasons 1903 and 1904, by W. H. Osgood, is now in press.

A large amount of data on the migration of North American birds has been gathered by W. W. Cooke during the year and tabulated for future use. In addition to the above, advance has been made in digesting and arranging for immediate reference the data on the distribution of birds and mammals. Work on the distribution maps has been pushed as rapidly as the exigencies of other and more pressing work permitted.

GAME PROTECTION.

The work of game protection under the various acts of Congress relating to the preservation of birds and game and the importation of birds and mammals into the United States continues to grow in volume and importance. The scope of the work is broadening yearly, and the variety of records necessary as a basis for quick and intelligent action is constantly increasing.

IMPORTATION OF FOREIGN MAMMALS AND BIRDS.

As required by the act of Congress of May 25, 1900, constant supervision has been maintained over the importation of birds and mammals into the United States. In connection with this duty 76 inspections have been made at New York, 4 at Philadelphia, and 13 at Honolulu. Eight starlings, discovered in a bird store in Philadelphia in November, 1908, were turned over to the Philadelphia Zoological Garden. In January, 1909, the same species was refused entry at New York. At Honolulu, April 26, a Japanese merchant applied for a permit to enter a lot of Japanese nuns or bengalees (*Uroloncha acuticauda*) and Java sparrows or ricebirds (*Padda oryzivora*). As these birds have proved destructive in the Orient, the permit was refused and the birds were destroyed. The constant danger of the introduction of the mongoose is emphasized by the killing of one of these pests on Cape Cod in August, 1908, by a farmer whose fowls it was destroying. How it was introduced into the country is unknown.

Owing to efforts to import from Mexico birds the sale and possession of which are prohibited in most States, it was found expedient to require the production of a state permit or other authorization from local officials before permitting entry.

Among the importations under permit the principal interest attaches, as last year, to the introduction of European partridges for stocking game covers, the State of Connecticut being particularly active in this regard. The growth of popularity of this bird for stocking depleted covers is shown by the rapid increase in the number imported—50 in 1904–5, 736 in 1905–6, 3,075 in 1906–7, 7,081 in 1907–8, and 29,832 in 1908–9. About 1,200 pheasants (including 105 pure English pheasants) and 640 Mexican quail were also imported for liberation. Aviary pheasants were imported to the number of 1,100, among which were included 15 Formosan, 16 Prince of Wales, 16 true Mongolian (*Phasianus mongolicus*), 15 black-backed kaleeges, and 2 each of the rare monauls (or impeyan pheasants), Temminck tragopans, and red jungle fowls. The total number of game birds of all kinds brought in was 34,996, an increase of 20,298 over the previous year's figures.

The nongame birds imported comprised 314,170 canaries and 39,699 miscellaneous birds. Among the former were 4,485 Norwich, 60 cinnamon, 12 Belgian, and 24 mule canaries, and 28 Lancashire coppies. Perhaps the most interesting of the miscellaneous birds were 139 shâma thrushes. The greatly increased imports of these fine Indian songsters are largely due to an effort to substitute them for the mockingbird, which can no longer be sold in most States. Other noteworthy importations were 36 Lady Gould finches, 50 East Indian nonpareils, 30 dwarf amadines, 10 silver-eared mesias, 4 dial birds, and one consignment of 500 Indian yellowhammers.

Mammals were imported to the number of 1,179. Of special interest was a consignment of 5 wallabies, 2 opossums, and 4 Tasmanian devils from Tasmania, temporarily placed on exhibition at the Alaska-Yukon-Pacific Exposition.

The number of game-birds' eggs imported was 5,050, of which 1,910 were wild mallard duck eggs, 2,580 pheasant eggs, and 560 partridge eggs.

To these must be added the following imports without permit: Twenty-four thousand and eighty-six canaries, 13,073 parrots, 1,753 miscellaneous birds, and 1,024 mammals, thus making the total importations from July 1, 1908, to June 30, 1909, 338,256 canaries, 89,521 miscellaneous birds, 2,203 mammals, and 5,050 eggs of game birds.

A card index is kept of the species imported, which, when brought up to date, will not only show the number of birds and mammals entering the United States since 1900, but will furnish a serviceable record of the earliest importation of many interesting species. In order to extend its field, the index will be supplemented in special cases by the earlier history of introduction of the species into Europe as well as the United States.

BIRD RESERVATIONS.

During the year the number of bird reservations has more than trebled (having been increased from 16 on July 1, 1908, to 51 on June 30, 1909), and two of the older reservations, Pelican Island and Mosquito Inlet, Fla., have been enlarged. The date of establishment,

name, and location of the thirty-six reservations established during the year are as follows:

No.	Date.	Location.	No.	Date.	Location.
17	Aug. 8, 1908	Key West, Fla.	35	Feb. 25, 1909	Strawberry Valley, Utah.
18	.....do.....	Klamath Lake, Oreg.	36	.....do.....	Keechelus, Wash.
19	Aug. 18, 1908	Lake Malheur, Oreg.	37	.....do.....	Kachess, Wash.
20	Aug. 28, 1908	Chase Lake, N. Dak.	38	.....do.....	Clealum, Wash.
21	Sept. 15, 1908	Pine Island, Fla.	39	.....do.....	Bumping Lake, Wash.
22	Sept. 26, 1908	Palma Sola, Fla.	40	.....do.....	Conconully, Wash.
23	.....do.....	Matlacha Pass, Fla.	41	.....do.....	Pathfinder, Wyo.
24	Oct. 23, 1908	Island Bay, Fla.	42	.....do.....	Shoshone, Wyo.
25	Oct. 26, 1908	Loch Katrine, Wyo.	43	.....do.....	Minidoka, Idaho.
26	Feb. 3, 1909	Hawaiian Islands, Hawaii.	44	Feb. 27, 1909	Bering Sea, Alaska.
27	Feb. 25, 1909	Salt River, Ariz.	45	.....do.....	Tuxedni, Alaska.
28	.....do.....	East Park, Cal.	46	.....do.....	St. Lazaria, Alaska.
29	.....do.....	Deer Flat, Idaho.	47	.....do.....	Yukon Delta, Alaska.
30	.....do.....	Willow Creek, Mont.	48	.....do.....	Culebra, P. R.
31	.....do.....	Carlsbad, N. Mex.	49	.....do.....	Farallon, Calif.
32	.....do.....	Rio Grande, N. Mex.	50	.....do.....	Pribilof, Alaska.
33	.....do.....	Cold Springs, Oreg.	51	Mar. 2, 1909	Bogoslof, Alaska.
34	.....do.....	Bellefourche, S. Dak.			

These reservations may be divided into several groups, according to the kinds of birds protected. They differ in character and size from any of the reservations previously established. Thus Klamath Lake and Lake Malheur reservations in Oregon and the Yukon Delta Reservation in Alaska comprise considerable areas of marshy land that form breeding grounds for wild fowl of various kinds. The Hawaiian Islands reservation, comprising a number of islets in mid-ocean, is one of the largest and most famous breeding colonies of sea birds in the world. It covers 5 degrees of latitude and 20 degrees of longitude. Most of the reservations in the interior in Arizona, California, Idaho, Montana, New Mexico, Oregon, South Dakota, Utah, Washington, and Wyoming are on reservoir sites of reclamation projects, since, when the reservoirs are completed, birds will undoubtedly be attracted in large numbers to these artificial lakes in arid regions.

A case is pending in which the act of June 28, 1906, prohibiting trespass on bird reservations will be tested in the courts. On March 16, 1909, a visitor to Mosquito Inlet Reservation, Fla., despite the warning of the warden, shot and killed 4 pelicans. Complaint was made before the United States commissioner, and the offender was bound over to await the action of the grand jury next December.

It is gratifying to note that 8 of the colonies of birds protected by the Federal Government have already been utilized for special study. On Tortugas Keys, under the direction of the Carnegie Institution of Washington, an elaborate investigation has been begun of the life history of sea birds: problems of migration, the homing instinct, and other features of bird life have been carefully studied, and results of the first year's work have been published. Klamath Lake and Pelican Island reservations, Three Arch Rocks Reservation, Oreg., the three reservations off the coast of Washington, and Breton Island Reservation have recently formed the subjects of articles by ornithologists.

MONTANA BISON RANGE.

In the Agricultural Department appropriation bills for 1909 and 1910 and the general deficiency bill for 1909 (act of May 23, 1908,

and two acts of March 4, 1909) provision was made for the purchase of 20,000 acres of land on the Flathead Indian Reservation in Montana for a national bison range, and $13,000 was allowed for fencing, the buffalo to be furnished by the American Bison Society. In furtherance of this project the range was selected by the Chief of the Bureau, in cooperation with an engineer of the Forest Service and the chairman of the commission appointed to allot the lands of the Flathead Indian Reservation. Bids for constructing the fence were called for, but proved too high, so that the Forest Service has undertaken to build the fence. It may be stated that the American Society has already raised $10,500 for the purchase of buffalo, and has the promise of 14 as gifts. It is ready to place a herd of at least 50 buffalo on the reservation as soon as the fencing is completed.

OLYMPIC NATIONAL MONUMENT.

Special protection was afforded elk in Washington by the act of the President in setting aside the higher summits of the Olympics as a national monument. These mountains are the center of the region inhabited by the Roosevelt elk, and protection by setting aside their summer range is necessary to their preservation.

PROTECTION OF GAME IN ALASKA.

The new Alaska game law of May 11, 1908, was given wide publicity throughout the Territory in a circular published August 1, 1908, which contained the text of the law and the departmental restrictions. These regulations have remained unmodified, except for a change in relation to the capture and sale of deer, which was published March 6, 1909. The new law permitted shipment of trophies until September 1, 1908, without permit or license, and under this exemption about 175 trophies were shipped from the Territory, comprising moose, mountain sheep, caribou, brown bears, mountain goats, and deer. Thirty-eight permits were granted for collection and export of specimens. Eighty-one of the specimens exported under these permits, chiefly heads and horns of moose, caribou, and sheep, were shipped to Seattle for exhibition at the Alaska-Yukon-Pacific Exposition. Provision is made by the new law for the employment of game wardens, but in the absence of an appropriation for that purpose for the current year none were appointed. The sundry civil appropriation bill for the year ending June 30, 1910, however, carries an appropriation of $10,000 for warden service, and thus furnishes means for proper enforcement of the law.

INFORMATION CONCERNING GAME.

The increasing number of requests for information concerning game has shown the importance of augmenting the resources of the survey by making additional indexes and summaries. Early in the year effort was begun to systematize the data already collected and to extend the work, particularly by obtaining more definite reports of the amount of game killed, statistics of the abundance of game, and a more complete record of the bills under consideration in State legislatures.

Big game.—In connection with the preliminary investigation of the conservation of natural resources, such statistics as were available were collected respecting the amount of big game killed, the receipts from hunting licenses, and the increased value of land due to the presence of game—in short, the value of game as a natural resource. With a view to the collection of more accurate information in the future, the subject was taken up with several of the State game commissioners, and in two or three instances provisions were incorporated in the game bills requiring hunters to make returns at the end of the season of the number and kind of big game and of game birds killed. But although the game warden departments showed full appreciation of the value of the work, the time was too short to educate the public to the importance of such data, and most of the provisions failed of enactment. Special attention was paid to the collection of data showing the number of deer killed during the season of 1908 and the present numbers of antelope. Through the commissioners of Maine, Vermont, New York, Pennsylvania, South Carolina, Wisconsin, Minnesota, Louisiana, and Colorado, estimates were obtained of the total number of deer killed in those States during the past season, and through correspondence with local observers similar figures were obtained for Michigan, Maryland, West Virginia, Virginia, Alabama, Mississippi, Florida, and California. As a number of States afforded no deer hunting during the season, the estimates collected give for the first time a fair approximation to the total number of deer killed east of the Mississippi (except in New Hampshire, North Carolina, and Georgia) and also in Colorado and the most important counties of California. The total number was about 60,000. This work merits further extension, and it is hoped that soon a complete census can be furnished of the deer killed annually—at least east of the Mississippi.

In the West information concerning the present number of antelope was obtained from various sources. Some of the data were summarized and placed in the hands of persons interested in securing better protection for the species. Correspondence was had with game commissioners and others in several of the States where the season was still open, with a view to giving protection throughout the year. As a result of combined efforts the season was closed for several years in Montana, Wyoming, and Oregon. In Montana this legislation is of special importance from the fact that the Yellowstone National Park herd, part of which winters outside of the park in the vicinity of Gardiner, is in jeopardy so long as the Montana season is open.

During the year details were collected concerning legal restrictions on the hunting of big game in the United States and Canada.

Index of game legislation.—The index of game legislation, begun several years ago, has made good progress during the year, and now promises to be of great value. The game laws of all the States west of the Mississippi are now indexed, and also those of Alabama, Florida, Georgia, Michigan, and West Virginia, making 27 States in all. In addition to these complete indexes, partial ones have been made of the game laws of New York, Virginia, and North Carolina. When the index has been completed for the last decade in all the States, it will furnish interesting data on the relative number and cost

of game laws. The United States enacts more game laws than any other country—in some years more than all other countries combined. The value of such legislation is often questioned, and the need of reform has frequently been urged in governors' messages. During the past year three commissions have been appointed—in California, Maryland, and New Jersey—with a view to devising a practicable method to stay the flood of game bills which overwhelms the committees in some State legislatures. The question is important and a satisfactory solution will prevent much waste of time and money.

Game laws of the United States and Canada.—In September, 1908, the usual summary of game laws was published and distributed as Farmers' Bulletin 336; also two posters of close seasons (one general for the United States and Canada and one special for Maryland, the District of Columbia, Virginia, and North Carolina) were issued.

Game protection in 1908.—In the résumé of the year's progress in game protection prepared for the Yearbook, the condition of game, particularly big game, was again made a prominent feature.

Directory of game officials.—The annual circular showing the names and addresses of state game officials and organizations and Audubon societies was issued in August.

Stocking covers.—Many details of transactions in imported game birds and eggs for stocking covers were gathered. The growing scarcity of native game birds gives added importance each year to this phase of the work. Game officials and private preserve owners continued to import European game birds for restocking, the number of Hungarian partridges brought in being particularly large. The eggs of game birds imported consisted chiefly of those of pheasants and wild mallard ducks. These experiments are followed up as closely as possible and a careful record is kept of the results.

Pheasant raising.—Special investigation was made of the propagation of pheasants. A number of pheasantries in New York, New Jersey, and Illinois were visited by a representative of the Survey, and the information secured formed the basis of a report now being prepared.

Private game preserves.—The information collected regarding private game preserves in the United States is nearly ready for publication. It will include deer parks and private preserves stocked with deer and other big game. The data secured comprise the location, area, and date of establishment of each preserve, the character of fencing, the kind of game with which it is stocked, the success in breeding, and other items. It not only will serve as a directory of private preserves, but will in effect provide a census of big game in captivity in the United States, except in zoological gardens, at the close of 1908.

Fur-bearing animals.—The various state and national restrictions in force concerning fur-bearing animals were compiled in response to numerous requests from trappers and others interested.

Wild turkeys.—Through systematic correspondence statistics were secured from a number of States showing the localities in which wild turkeys still occur and the number killed during the last open season.

Ducking grounds.—With a view to securing further information on ducking grounds of the United States, the well-known ducking grounds at the head of Chesapeake Bay were visited during the year; much information also was secured concerning those on the Illinois River.

Hunting accidents.—Investigation of the nature and causes of hunting accidents was continued. The data secured have been filed in convenient and readily accessible form as a basis for legislation aimed to prevent such accidents.

Hunting-license statistics.—Statistics were secured from Great Britain, France, and Switzerland, showing the receipts for hunting licenses during the past ten years. These are of interest for comparison with similar figures for the United States.

Appropriations for game protection.—Compilation was made of the state funds set aside for game protection in 1907–8. This information is complementary to the report already published of appropriations for 1905–6.

Thanksgiving game.—The usual data concerning the prices and abundance of game in the markets immediately preceding Thanksgiving Day were gathered.

COOPERATIVE WORK.

Cooperation with state game officials and others interested in game and birds continues to be an important phase of the work. During the year many requests were received that representatives of the Survey be sent to appear before committees of state legislatures in regard to matters relating to the protection of game. Though it was impossible to comply with all these requests, visits were made to New Jersey, Michigan, and Wisconsin. Information was furnished on request to California, Louisiana, Minnesota, Oregon, Texas, and Wyoming. A summary of the entire game legislation of Alabama, covering 108 years, was sent to a game commissioner of that State; and aid was given Virginia in securing better protection for non-game birds.

INTERSTATE COMMERCE IN GAME.

Owing to the construction placed on the marking provisions of the Lacey Act by the federal court of North Dakota and on the state law of Illinois by the attorney-general of that State, together with the unfavorable legislation of the previous year in Missouri, fewer cases than usual involving illegal interstate shipments of game were brought to the attention of the department. These defects, however, have been largely remedied. Through the passage of the penal code, sections 3 and 4 of the Lacey Act were materially strengthened and broadened, and by the enactment of new statutes in Illinois and Missouri at the last legislative sessions the local laws were greatly improved. The importance of the modification of these laws is apparent when it is considered that state laws form the basis of the Lacey Act and that more interstate shipments of game pass through Kansas City, St. Louis, and Chicago than pass through any other cities. After January 1, 1910, when the penal code goes into effect, the De-

partment should be in a position to enforce the Lacey Act much more effectively than heretofore.

The number of new cases arising under the Lacey Act was nine. Of these, six were shipments of game birds from New York to Connecticut, New Jersey, Pennsylvania, and Maryland, originating on information furnished by the Bureau of Animal Industry in connection with the enforcement of the meat inspection act; two involved introduction of prohibited species of mammals and birds; and one arose through unlawful export of game birds from Iowa. The New York cases were referred to the forest, fish, and game commission of New York and prosecuted under the state law. Four resulted in convictions; the other two are still pending. The two cases relating to prohibited species were settled out of court, and the two Iowa cases are still pending. Among the cases pending for several years, one which involved the shipment of 512 quail from Oklahoma, and which had been referred to the Department of Justice in 1905, was decided. The defendant was fined $100 on each of four indictments, or $400 in all.

The following is a list of these cases:

Violations of the Lacey Act arising or settled during the year ending June 30, 1909.

Defendant.	Place.	Offense.	Disposition.
Importer unknown	Philadelphia, Pa	Importation and shipment of 8 starlings in violation of secs. 2 and 3 of Lacey Act.	Settled out of court.
Fischer	Washington, D. C	Importation and shipment of 1 flying fox in violation of secs. 2 and 3.	Do.
Andrew Reuhl	New York	Illegal shipment of 33 ducks	Fine $50; paid.
N. Low & Son	do	Illegal shipment of 2 ducks	Fine $25; paid.
John M. Isemann	do	Illegal shipment of 12 quail	Do.
Samuel Katz	do	Illegal shipment of 2 ducks, 4 quail.	Do.
Steigerwald Packing Co.	do	Illegal shipment of 12 quail	Pending.
Samuel Katz	do	Illegal shipment of 2 ducks	Do.
Paris N. Ruppert	Okeene, Okla	Illegal shipment of 512 quail.	Fine $400; paid.
J. D. Carson	Marion, Iowa	Illegal shipment of 41 prairie chickens.	Pending.

OUTLINE OF WORK FOR 1910.

ECONOMIC ORNITHOLOGY AND MAMMALOGY.

Work on the food habits of birds and mammals will be continued, including the examinations of stomachs and tabulation of their contents.

Field experiments will be continued to determine the best and most economical methods of destroying the California ground squirrel.

Two independent series of experiments will be carried on—one in New Mexico, the other in Wyoming—to determine the cheapest effective poison and the most attractive bait for exterminating prairie dogs.

Field work will be carried on in Arizona, California, Oregon, and Washington in connection with the destruction of gophers, ground squirrels, kangaroo rats, and other burrowing animals which dig into and weaken irrigation embankments and fills.

Preliminary studies of the food habits of the mole will be made in Virginia, Maryland, and the District of Columbia. As many stomachs of the mole as possible will be collected to determine the exact nature of the animal's food and especially to what extent, if any, it eats vegetable food.

Observations on the habits and depredations of the pine mouse will be carried on.

The relation of the food of birds to the fruit industry will be studied in Washington, southeastern California, and the Gila and Salt River valleys of Arizona.

Preliminary studies will be carried on in Massachusetts for the purpose of ascertaining what birds feed upon the gipsy and brown-tail moths. In connection with this work field observations will be made to ascertain the extent of the mortality among birds caused by the use of spraying solutions of arsenite of lead.

The relation of the continued diminution of waterfowl and shore birds to the food supply will be investigated along the coast line from Massachusetts to South Carolina.

GEOGRAPHIC DISTRIBUTION.

The biological survey of Utah, begun many years ago but discontinued because of lack of funds, will be continued the present year. Considerable work in relation to a life-zone map of North Dakota has already been done. The University of North Dakota has asked the Survey to cooperate with a view to completing and publishing a biological map of the State, and it is hoped that arrangements can be made for cooperation. The biological survey of California, in progress for several years, will be continued. Field work in Colorado has been completed, and in New Mexico will be completed during the present field season and the results published at as early a date as practicable.

GAME PROTECTION.

During the coming year much time will necessarily be occupied in keeping up to date the various current records concerning game and in completing work already begun. The consolidated card index of species imported since the passage of the Lacey Act, May 25, 1900, has progressed far enough to insure its completion. The index of game legislation, which now covers all the States west of the Mississippi and several eastern States, will be pushed as rapidly as possible, and by the end of the year, it is hoped, will be complete for at least the past decade in all the States.

The compilation of the laws relating to fur-bearing animals is practically completed, and will be made the basis of a bulletin during the coming year.

Work will be continued on the index of decisions in cases involving questions relating to game, and will be advanced as far toward completion as pressure of other work will permit.

The various other records maintained by the Survey, relating to game preserves, appropriations for game protection, hunting licenses, statistics of big game, and hunting accidents, will be continued.

As 1910 will complete the first decennial period, not only of the century but also of federal bird and game protection under the

Lacey Act, it is intended to prepare for publication a ten years' review of bird and game protection and of the importation of birds and mammals, including legislation and other phases of the subject. Such a review will serve a useful purpose in showing the progress of the past ten years, its trend, its successes, and its failures.

Certain changes are contemplated in the summary of game laws. When the Department first undertook the publication of tables showing the season for hunting, the game laws of some of the States were incomplete, and it was possible only to follow their provisions and to publish tables showing the periods during which hunting is prohibited. To ascertain the open seasons it was necessary to reverse the dates published by the Department. This inconvenience has long been recognized, and the state laws having been so far perfected as to cover practically all game, a radical departure will be made this year by publishing the open seasons instead of the closed, so that sportsmen, dealers, and others can ascertain at a glance the period of the year when game can be legally hunted or had in possession. In making this change the opportunity will be taken to reexamine carefully all the dates for the various seasons in each State.

As a means of expediting correspondence, experience has demonstrated the need of printing brief circulars on a number of topics concerning which inquiry is frequently made. These can be issued from time to time and can be revised and brought down to date when necessary. Material has already been collected for a condensed circular to contain all the restrictions on big game hunting in the United States and Canada. Other subjects under consideration are spring shooting, statistics of hunting licenses, bag limits, federal bird reservations, game protective organizations, warden service, and provisions of state laws affecting the millinery trade.

Congress having made an appropriation for the maintenance of Federal bird reservations, a readjustment of salaries of wardens will be made, and, as far as funds permit, warden service will be established on reservations not already in charge of wardens.

The increasing use of bird reservations for studying different phases of bird life will be encouraged in every way possible. Besides the work of the Carnegie Institution of Washington at the Tortugas Keys Reservation, other studies are already in prospect. The Bureau of Fisheries is desirous of making certain investigations on the Pribilof Reservation, and arrangements for such cooperation have already been completed. An application has also been received for permission to collect material on Laysan Island, in the Hawaiian Reservation, for installing in the University of Iowa one of the most elaborate bird groups ever undertaken in this country. Warden service will be established on the Montana Bison Range, and every possible precaution will be taken to care for the valuable herd presented to the Government by the American Bison Society. The various projects for game refuges now under consideration will be given thorough examination in order that the Department may be provided with the fullest possible information concerning the details and merits of each.

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